"The important thing is not to stop questioning. Curiosity has its own reason for existing." – Albert Einstein

The Wonderful World of Science

The Big Question

Imagine a world without your smartphone, where the lights never turn on, and cars couldn't start. What invisible force powers all these incredible inventions, from tiny gadgets to massive machines? This chapter will reveal the secrets behind this everyday marvel – science! It's not just in labs; it's everywhere, helping us understand, create, and solve problems.

Meet EeeBee.AI

Hello, curious minds and future innovators! I'm EeeBee, your AI buddy. Let's dive into science—exploring the natural world, understanding its laws, and discovering how we apply this knowledge to invent, improve, and even protect our planet! **Still curious? Talk to me by scanning the QR code.**

Learning Outcomes

By the end of this chapter, students will be able to:

- Develop a sense of wonder about the world and feel motivated to ask questions.
- Identify science as a method of observing, questioning, and investigating.
- Utilize observation, forming hypotheses, conducting experiments, and analyzing results to address challenges.
- Connect observations to principles and discover science's role in daily life.

From Last Year's Notebook

- What Are Living and Non-living Things?
- Characteristics of Living and Non-Living Things

Science Around You

Science is the continuous quest to understand the universe. From predicting weather patterns and developing new medicines to exploring distant galaxies and designing sustainable energy solutions, its influence is boundless. Embracing scientific thinking helps us question, experiment, and build a better future for everyone.

NCF Curricular Goals and Competencies

This chapter focuses on the following curricular goals and skills:

CG-3 (C 3.1, 3.2, 3.3, and 3.4): Investigates the living world and its relationship with the non-living environment from a scientific perspective.

CG-6 (C 6.1 and 6.2): Explores the fundamentals and advancements in science, fostering scientific inquiry and understanding through observation and experimentation.

Mind Map

The Wonderful World of Science

Science Universe

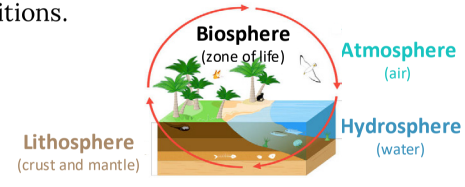
❖ **Science : Its Curiosity and Practical Impact**

❖ **Science** is the study of the natural world through observation, experimentation, and reasoning.

✓ Curiosity in science is the desire to explore, question, and understand how the world works.

❖ **Earth and Ecosystem**

- Earth's ability to support life is due to its perfect combination of resources and conditions.



Food and Water

✓ Food provides energy and nutrients essential for growth, development, and survival of all living beings.

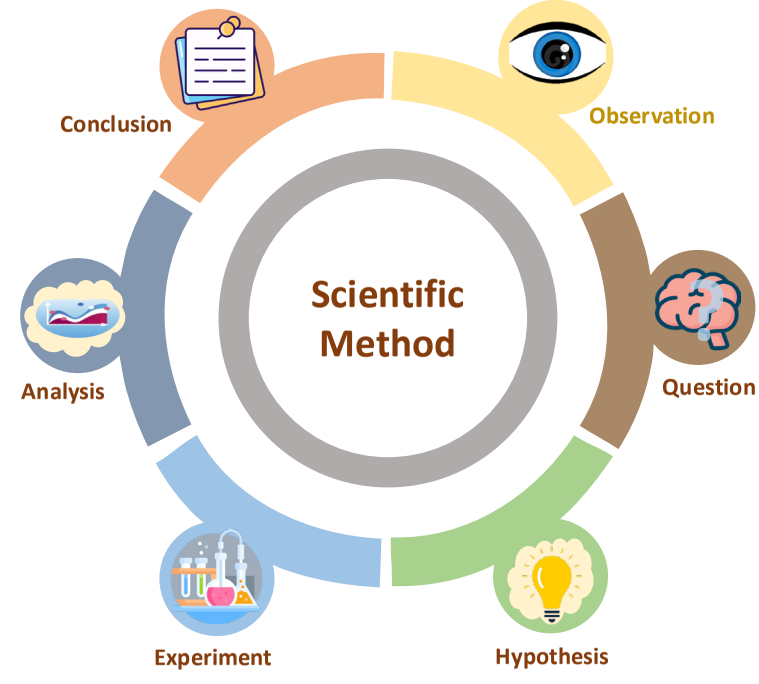
✓ Water is vital for life, supporting hydration, agriculture, hygiene, and ecological balance.

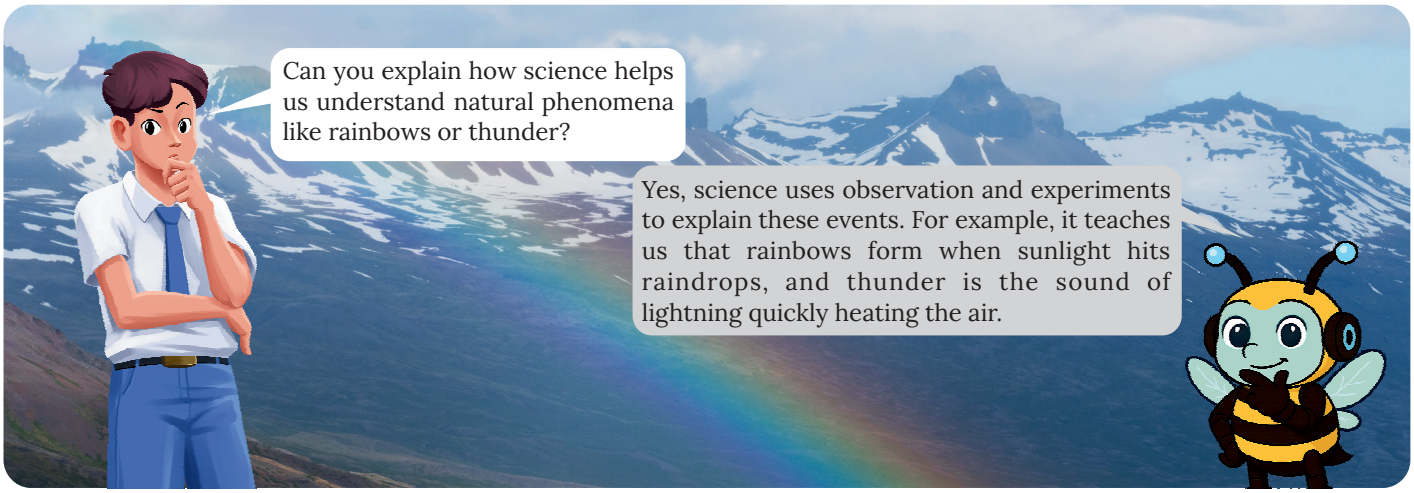
Materials Around Us

✓ We separate different materials using methods like handpicking, sieving, filtration, and evaporation based on their physical properties.

✓ Recycling is the process of converting waste materials into reusable materials to conserve resources and reduce pollution.

The Scientific Method





In Focus

- Science Universe
- The Scientific Method

Introduction

From the moment we are born, humans exhibit an innate sense of curiosity about the world around them. This fundamental characteristic drives us to explore, question, and seek understanding. This curiosity is evident even in the earliest stages of life, as babies and toddlers constantly engage with their environment. They touch, taste, listen, and observe with unrelenting enthusiasm, learning through every experience. Whether they are trying to understand the texture of a surface, the taste of an unfamiliar object, or the movement of light and shadows, their actions reflect an instinctual desire to make sense of the unknown.

From History's Pages

The universe began 13.8 billion years ago with the Big Bang, a massive explosion that started time, space, and matter. In moments, it expanded rapidly, forming particles that combined into hydrogen and helium. Over time, gravity pulled these together, creating stars and galaxies. Around 4.6 billion years ago, the Solar System formed, and Earth emerged as a rocky planet supporting life. Single-celled organisms like bacteria appeared 3.5 billion years ago, evolving into complex life. About 66 million years ago, a mass extinction wiped out the dinosaurs, paving the way for mammals. Humans evolved around 300,000 years ago, eventually achieving space exploration.

Science Universe

What is Science?

Science is a systematic approach to understanding the universe and everything within it. It revolves around observing the world, formulating questions, making predictions (hypotheses), conducting experiments, and interpreting the results. This process helps us uncover the mysteries of nature and solve complex problems.

At its core, science is driven by curiosity—a deep desire to learn and comprehend the world better. This curiosity is not limited to professional scientists; it exists in all of us. From asking simple questions about everyday phenomena to conducting experiments to find answers, we all engage in science in some way or another.

Curiosity as the Foundation of Science

Fig. 1.1 Curiosity in Science

Curiosity is the driving force behind every scientific endeavor. It is the urge to explore, investigate, and understand the unknown. For example, think about the time you disassembled a toy just to see how it works. That act of exploring the toy's mechanics was science in its simplest form. Every time you wonder about how or why something happens, you are embarking on a scientific journey.

Science is Everywhere

Have you ever looked up at the stars, watched a flower bloom, or wondered how your phone works? Guess what—that's all science in action! Science is like a secret superhero that's always around us, helping us understand the world and making life better every single day.

From the tiniest grain of sand to giant mountains, from the soft petals of a flower to the buzzing of bees in a forest—science explains how everything works. It's in nature, in the gadgets we use, and even in our own bodies!

Amazing Examples of Science Around Us

Let's explore some cool ways science shows up in everyday life:

- **Stars Twinkling in the Night Sky:** Stars shine because of powerful reactions happening deep inside them. These reactions release energy, and that's the light we see from Earth. So next time you stargaze, remember—you're looking at science in action!
- **Flowers Blooming in a Garden:** Flowers don't just bloom randomly. They respond to sunlight and temperature. Through a process called photosynthesis, they turn sunlight into food and grow beautifully. Isn't that amazing?
- **Thinking and Learning:** Even your brain uses science! Neurons send signals, helping you think, learn, and remember things.

Fig. 1.2 Science Around Us

How Science Helps Us in Real Life

Science isn't just about cool facts—it helps people in big ways!

- **Farming:** Scientists study plants and soil to help farmers grow more food.
- **Medicine:** Doctors use science to treat diseases and keep us healthy.
- **Technology:** Phones, computers, and even video games are made using science!

Exploring Our Home, Planet Earth

Planet Earth is a unique and remarkable place, the only planet we know that supports life. It is home to an extraordinary variety of living organisms, environments, and ecosystems. The Earth provides everything that living beings need to survive—air, water, soil, and sunlight—forming a delicate balance that sustains life. Each corner of the planet, from the depths of the oceans to the peaks of mountains, hosts a rich diversity of life forms and plays a critical role in maintaining the planet's natural equilibrium.

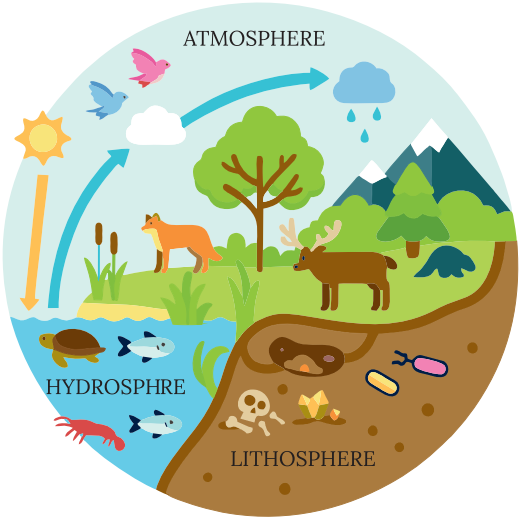


Fig. 1.3 A Living Planet

Earth: A Living Planet

Earth's ability to support life is due to its perfect combination of resources and conditions. From its breathable atmosphere, which provides oxygen and carbon dioxide for animals and plants, to its abundant water supply. The planet's environments range widely, creating the perfect habitats for different kinds of organisms.

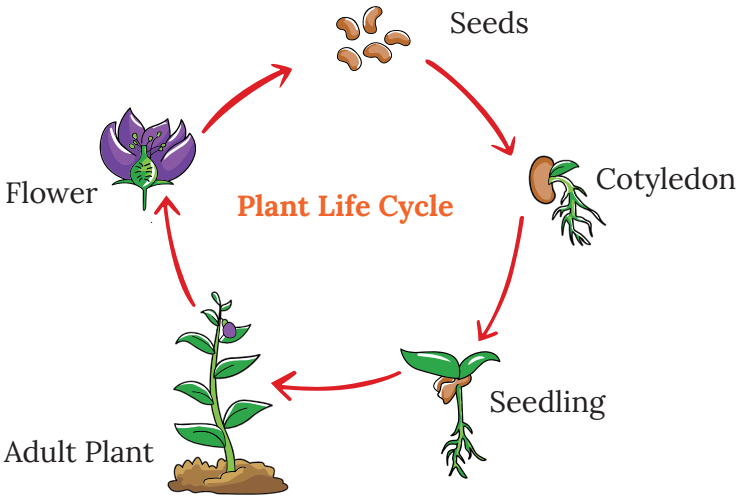


Fig. 1.4 Plant Life Cycle

Examples:

Plants: The journey of a seed growing into a plant is one of nature's simplest yet most awe-inspiring processes. A tiny seed, with the right combination of water, sunlight, and nutrients from the soil, grows into a thriving plant. This process, known as germination, is essential for maintaining life on Earth, as plants produce oxygen, food, and shelter for countless organisms.

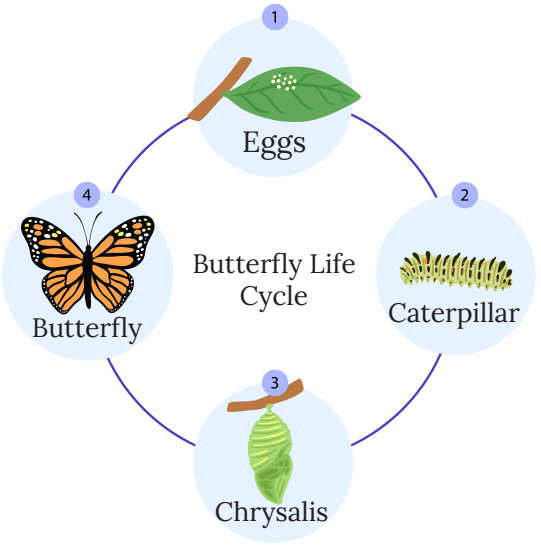


Fig. 1.5 Butterfly Life Cycle

Animals: Consider the fascinating transformation of a caterpillar into a butterfly. This process, called metamorphosis, in which the caterpillar undergoes a series of developmental stages to emerge as a beautiful butterfly. Such transformations showcase the complexity and adaptability of life on Earth.

Ecosystems: The Web of Life

Ecosystems are diverse environments where living organisms interact with each other and their surroundings. These systems include forests, oceans, deserts, wetlands, grasslands, and tundras. Each ecosystem has its unique plants, animals, and environmental conditions, creating a network of life that depends on interconnection and balance.

Ecosystems are vital for the survival of all living organisms. They regulate essential processes such as air and water purification, climate control, and nutrient cycling. Different ecosystems play distinct roles in supporting biodiversity and providing habitats for countless species.

Examples:

In a dense forest, trees serve as homes for animals such as birds, insects, and monkeys, while their leaves release oxygen into the atmosphere during photosynthesis. The forest floor is teeming with life, from fungi breaking down dead material to small animals foraging for food. Together, these elements work harmoniously to sustain the ecosystem.

Why Understanding Earth Matters

Exploring and understanding Earth's environments and ecosystems help us appreciate the planet's beauty and complexity. It also reminds us of our responsibility to protect it. By learning about the processes that keep Earth alive, we become more aware of how our actions impact the planet. Whether it's conserving water, reducing waste, or protecting forests, every small action helps in preserving the delicate balance of life on Earth.

Earth is not just our home; it is a shared space for millions of species. By studying and caring for it, we ensure that future generations can continue to thrive in harmony with the planet's natural wonders.

The Importance of Food and Water

Food and water are essential components of life. They provide the energy and resources we need to grow, survive, and thrive. While food nourishes our bodies and supports growth, water is crucial for hydration and maintaining various bodily functions. Together, they form the foundation of a healthy and sustainable lifestyle.

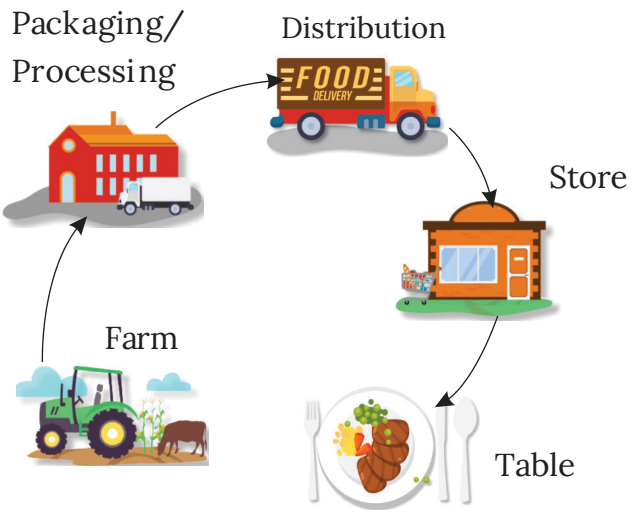


Fig. 1.6 Farm to Table

Food

Food is the primary source of energy for all living beings. It not only fuels our bodies but also helps in growth, repair, and maintaining overall health. The diversity of food available to us reflects the richness of nature and human culture. In India, for example, the variety of food is immense, with every region offering its unique flavors, ingredients, and dishes. This diversity showcases the strong relationship between food, culture, and the environment.

Example:

The next time you eat a meal, take a moment to think about the origins of each ingredient. Consider how rice is grown in paddy fields, how vegetables are cultivated in farms, or how spices are derived from seeds, roots, or flowers. This simple act deepens our connection to nature and the people who make our food possible.

Water

Water is vital for all forms of life. It is the most important natural resource on Earth, and without it, survival would be impossible. From hydrating our bodies to supporting ecosystems and agriculture, water plays a critical role in maintaining life.

Why Water is Essential:

- Water helps maintain body temperature and keeps the body hydrated. It prevents overheating and ensures that our organs work smoothly.
- It supports digestion by breaking down and absorbing food.
- Water carries nutrients and oxygen to all cells in the body.
- It also removes waste products, keeping the body clean and healthy.
- Beyond health, water is vital for farming, producing electricity, and protecting natural habitats. It ensures food supply, energy generation, and survival of plants and animals.

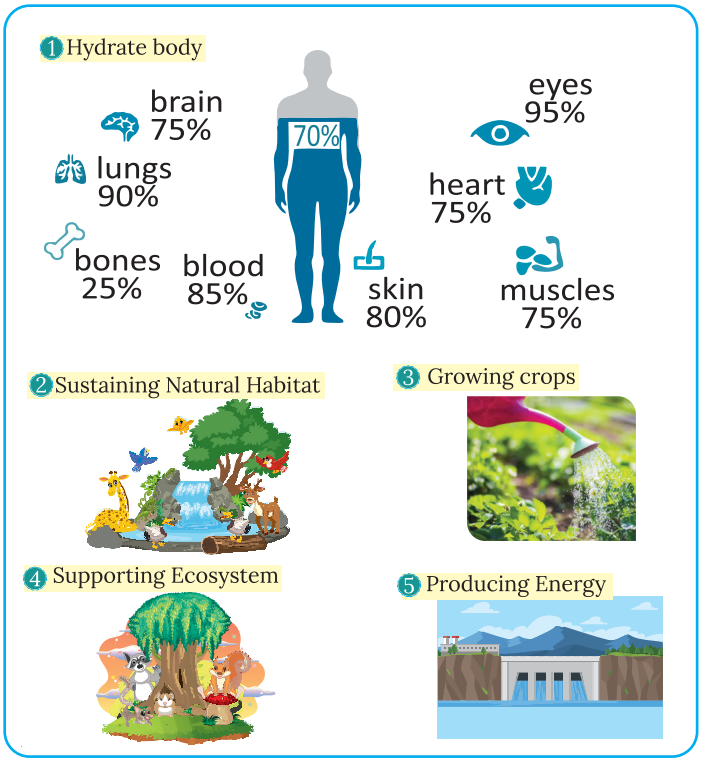


Fig. 1.7 Essential Functions of Water

Example:

Imagine a hot summer day when rain suddenly cools the atmosphere. The water cycle—**evaporation**, **condensation**, and precipitation—makes this possible. Or think about how farmers rely on water to irrigate crops, ensuring that we have food on our plates. These examples highlight the intricate connection between water and life.

Materials Around Us

Every day, we interact with a variety of objects that are made from different materials. These materials are selected based on their unique properties and suitability for a specific purpose. Think about the things you use daily—paper for writing, metal keys for opening locks, plastic rulers for measuring, rubber erasers for correcting mistakes, and clothes to keep you comfortable. Each of these items serves a different function because of the material it is made from.

Materials like metal, plastic, rubber, fabric, wood, and glass play an integral role in our lives. They are everywhere—from the tools we use to the buildings we live in. Each material has specific characteristics that make it suitable for certain applications. For example, metals are strong and durable, making them ideal for tools and machinery, while fabric is soft and flexible, perfect for clothing and upholstery.

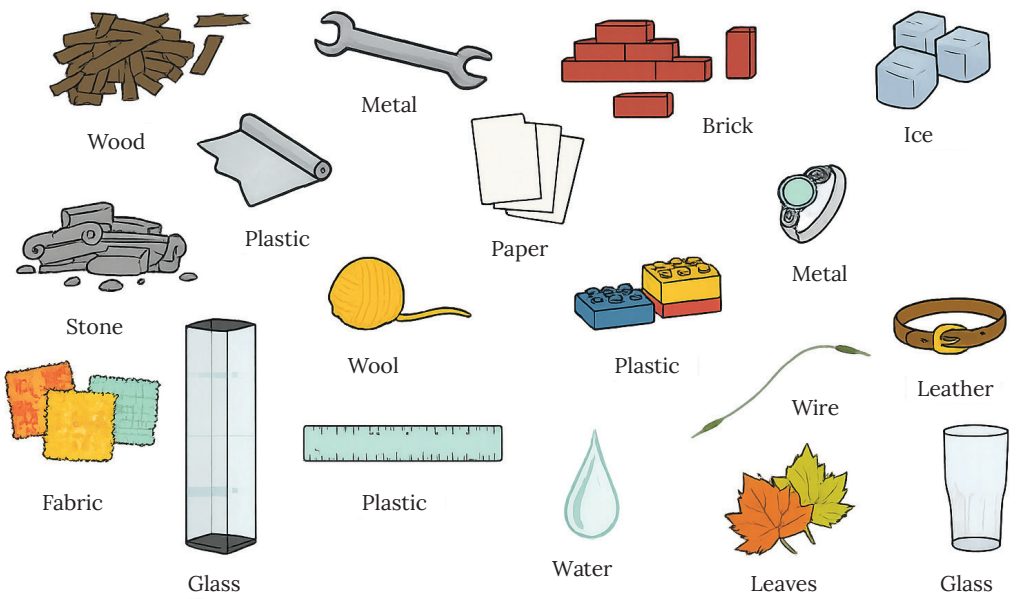


Fig. 1.8 Materials Around Us

Why Understanding Materials Matters

Knowing about the materials around us helps us appreciate how everyday items are designed and manufactured. It also enables us to choose the right material for a task and encourages mindful consumption by understanding the impact of different materials on the environment.

How Do We Separate Different Materials?

Separating materials is a crucial step in recycling and waste management. By identifying the properties of materials, such as their texture, weight, or whether they are biodegradable, we can effectively sort and recycle them. This helps in reducing waste, conserving resources, and minimizing environmental damage.

Keywords

Evaporation: It is the process where a liquid changes into a gas, usually from its surface, when heated.

Condensation: It is the process where a gas turns into a liquid on cooling.

Why Is Recycling Important?

Recycling reduces the need for raw materials, such as trees for paper or petroleum for plastic, thereby conserving valuable natural resources. It also decreases the energy required for manufacturing new products and lowers the level of pollution caused by waste disposal in landfills and incinerators. Recycling helps cut down greenhouse gas emissions, which contribute to climate change, and saves a significant amount of water and energy. It also helps protect wildlife, as less natural habitat is destroyed for extracting raw materials. Furthermore, recycling creates job opportunities in collection, processing, and manufacturing industries, supporting the economy. By separating and recycling materials responsibly, we ensure a cleaner, greener, and sustainable environment for future generations.

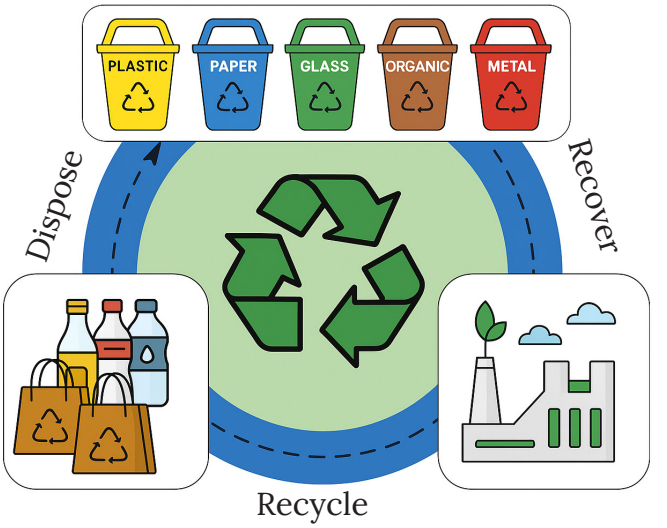


Fig. 1.9 Recycling Process

Example of Material Separation:

Imagine you are recycling household waste. You notice that there are plastic bottles, aluminum cans, and glass jars mixed in a single bin. To recycle effectively, you first separate the items into three categories: plastic, metal, and glass. After sorting, each group is sent to a recycling facility where the materials are processed and reproduced into new products.

Fact Flash

Did you know that a single drop of water contains billions of molecules? Also, honey never spoils! Archaeologists have found pots of honey in ancient Egyptian tombs that are over 3,000 years old and still perfectly edible!

Common Misconceptions

- × **Misconception:** The sun is on fire.
- ✓ **Correction:** The sun generates heat and light through nuclear fusion, not burning, in its core.
- × **Misconception:** Plants only grow in soil.
- ✓ **Correction:** While common, plants can also grow in water (hydroponics) or air (aeroponics) with proper nutrients.

Science Around You

Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. It allows us to understand everything from the smallest atoms to the largest galaxies. For instance, the Earth is constantly moving, spinning at approximately 1,670 kilometers per hour at the equator, and orbiting the sun at an astounding 107,000 kilometers per hour. This constant motion gives us day and night, and our seasons. Today, scientific breakthroughs like vaccines, which have eradicated diseases and saved countless lives, continue to transform human health and longevity.

Activity

Observing Plant Growth: The Seed Sprout Test

Objective: To observe the process of germination and early plant growth.

Materials: A few dried beans (e.g., mung beans, kidney beans), a small clear plastic cup or jar, cotton balls or paper towels, water.

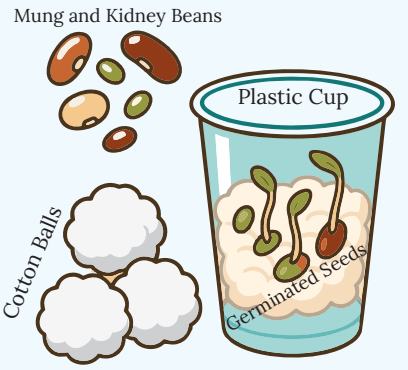


Fig. 1.10 Materials Required

- **Procedure:**
  - **Setup:** Place a layer of moist cotton balls or folded paper towels at the bottom of the cup.
  - **Planting:** Place 3-5 beans on top of the moist material, pressing them gently.
  - **Watering:** Add a little water to keep the cotton/paper towel consistently damp, but not waterlogged.
  - **Placement:** Place the cup in a location with indirect sunlight.
- **Observation:** Note when the first signs of germination appear (root), when the first shoot emerges, and how much the plant grows over a week.

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Remembering

Multiple Choice Questions:

1. What causes stars to twinkle in the night sky?

   (a) Reflection of the moon ☐ (b) Nuclear reactions ☐

   (c) Sunlight ☐ (d) Cloud cover ☐

Understanding

2. Which process allows plants to create their own food?

   (a) Respiration ☐ (b) Evaporation ☐ (c) Photosynthesis ☐ (d) Fermentation ☐

3. Which of these is NOT an example of a natural ecosystem?

   (a) Forest ☐ (b) Ocean ☐ (c) Desert ☐ (d) City park ☐

Short Answer Question:

Applying

4. Use science to explain two natural phenomena and describe two practical effects of scientific discoveries.
5. Explain the importance of germination for life on Earth and give one example of an organism with metamorphosis.

Long Answer Question:

Analyzing

6. Explain why Earth is considered a unique living planet. Describe three different examples of how living organisms interact within an ecosystem and discuss the importance of understanding Earth's environments for human responsibility.

The Scientific Method

The scientific method is a systematic process scientists use to explore the world, answer questions, and solve problems. It provides a reliable way to uncover truths about nature and understand complex phenomena through logical steps. These steps apply not only in scientific research but also in daily problem-solving, ensuring conclusions are based on evidence rather than assumptions.

Steps of the Scientific Method

Observation: The first step involves noticing something intriguing or unclear in the environment— a phenomenon, pattern, or event that raises curiosity. Careful observation identifies what needs deeper study.

Example: A plant at home always grows toward sunlight, no matter where it is placed.

Question: Once observed, the next step is to ask questions beginning with why, how, or what. These focus the investigation.

Example: Why does the plant grow toward light? Is it responding to sunlight?

Hypothesis: A hypothesis is an educated guess or prediction that attempts to answer the question. Based on prior knowledge or reasoning, it must be clear, concise, and testable.

Example: "The plant grows toward light to maximize sunlight absorption needed for photosynthesis."

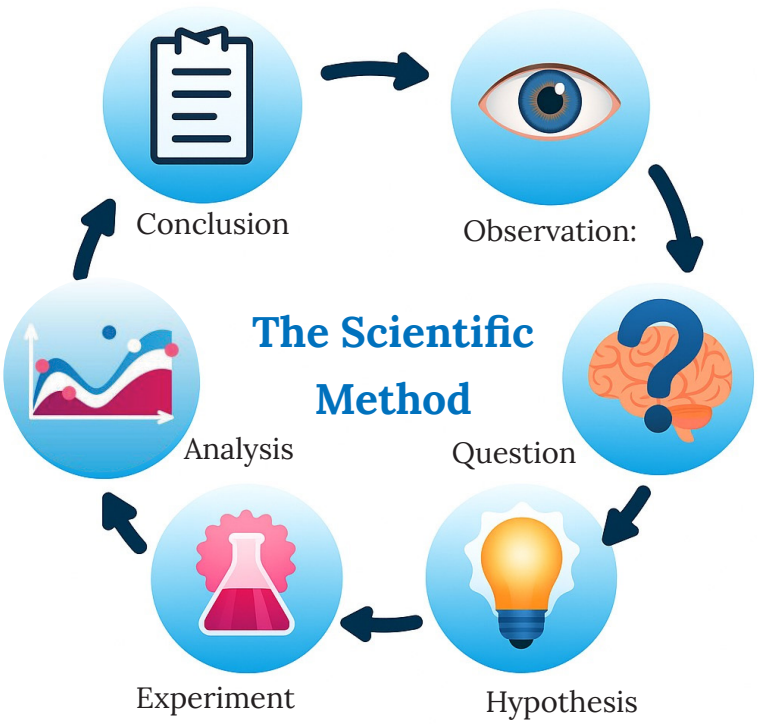


Fig. 1.11 Process of Scientific Method

Experiment: An experiment tests the hypothesis under controlled conditions. Only the variable being studied is changed while others remain constant. Repeating the experiment ensures reliable results.

Example: Place plants in bright light, dim light, and darkness. Observe their growth direction.

Analysis: Data from the experiment is studied to find patterns or trends and compared with the hypothesis. Graphs and charts often help visualize findings.

Example: Plants in bright light grew strongly toward the source, while those in dim light showed weaker growth.

Conclusion: The final step is drawing a conclusion. This answers the initial question and evaluates the hypothesis. If results support it, the hypothesis becomes valid; if not, it may be revised or retested.

Example: If plants in bright light consistently grow toward the light, the hypothesis is supported. Unexpected results may suggest other factors like temperature or humidity.

Importance of the Scientific Method

The scientific method plays a critical role in helping us find reliable answers to questions and solving problems in an organized manner. By following this systematic approach, we can avoid assumptions and base our understanding on evidence and logic. It ensures that our conclusions are accurate and rooted in observation and experimentation, making it a powerful tool for advancing knowledge and improving our understanding of the world.

Example of the Scientific Method

Problem: Flashlight Doesn't Turn On

1. **Observation:** You notice that your flashlight does not turn on when you press the power button. This is unexpected, as the flashlight was functioning properly the last time you used it. The light failing to work is the starting point for identifying the issue.
2. **Question:** The next step is to ask, "Why isn't the flashlight turning on?" This question focuses your investigation on the possible reasons behind the problem. The flashlight could have multiple issues, and asking this question narrows your focus to specific possibilities.
3. **Hypothesis:** Based on prior knowledge, you hypothesize that the flashlight's batteries might be dead. This is a logical guess since flashlights rely on batteries to operate, and batteries tend to lose their charge over time.
4. **Experiment:** To test your hypothesis, you replace the old batteries in the flashlight with new ones and try turning it on again. If the flashlight starts working, your hypothesis is correct. If it still doesn't work, you know the issue lies elsewhere, and you may need to revise your hypothesis.
5. **Analysis:** After replacing the batteries, you observe the flashlight's behavior. If it lights up, you can confirm that dead batteries were indeed the problem. However, if it remains off, you need to analyze further by considering other possibilities, such as a loose connection or a faulty bulb.

For example, if the flashlight still doesn't work, you could inspect the bulb to see if it is broken or check if the battery compartment has corrosion that might be disrupting the power supply.

6. **Next Steps:** If your analysis shows that the batteries were not the issue, you form a new hypothesis and test it. For instance, you might guess that the bulb has burned out. To test this, you replace the bulb with a new one and check if the flashlight works. If it does, you have successfully identified the problem and solved it.

   If replacing the bulb doesn't work either, you might investigate further by checking the flashlight's wiring or considering whether the power button itself is malfunctioning.

Importance of this Example

This process illustrates how the scientific method is not limited to complex laboratory experiments—it can be applied to everyday problem-solving situations. By systematically observing, questioning, hypothesizing, experimenting, and analyzing, you can identify and resolve problems efficiently. It also highlights how each step builds on the previous one, ensuring logical progression and conclusions.

Fact Flash

Did you know that the scientific method dates back to ancient times, with early forms being practiced by philosophers like Aristotle? Also, the earliest known use of a controlled experiment was in the 10th century by the Persian polymath Alhazen, who studied optics!

Common Misconceptions

× **Misconception:** The scientific method is a rigid, step-by-step process.

✓ **Correction:** It's an iterative and flexible process, often involving revisiting steps based on new findings.

× **Misconception:** A hypothesis is a proven fact.

✓ **Correction:** A hypothesis is an educated guess or proposed explanation that needs to be tested and validated.

Science Around You

The scientific method is a systematic approach to acquiring knowledge, forming the bedrock of all scientific inquiry. It begins with observation, leading to questions about natural phenomena. This process allows us to understand everything from how vaccines work to the laws of physics. For instance, observing apples falling led Isaac Newton to question gravity, eventually formulating his laws of motion. This rigorous methodology helps scientists develop testable explanations, or hypotheses, which are then subject to experimentation. Today, the scientific method continues to drive breakthroughs, transforming our understanding of the universe and solving complex problems in medicine and technology.

Activity

Testing a Hypothesis: The Plant Light Experiment

Objective: To test the hypothesis that plants grow better with more light.

- **Materials:**

  Two small identical potted plants, two identical containers (e.g., shoeboxes), a ruler, a notebook, a sunny window, a dark room.

- **Procedure:**
  - **Hypothesis:** Formulate a hypothesis, e.g., "Plants exposed to more light will grow taller than plants exposed to less light."
  - **Setup:** Place one plant in the sunny window (more light) and the other plant in the dark room (less light).
  - **Measurement:** Measure the initial height of both plants.
  - **Observation:** Water both plants equally every day. Observe and record their growth (height, number of leaves, general appearance) over two weeks.
  - **Data Analysis:** Compare the growth of both plants.
- **Observation:** Note the difference in height, leaf color, and overall health between the plant in the sun and the plant in the dark.

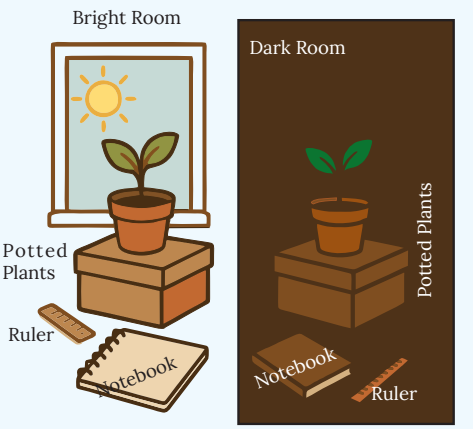


Fig. 1.12 Materials Required

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Remembering

Multiple Choice Questions:

1. What is the first step in the scientific method?

   (a) Experimentation ☐ (b) Observation ☐

   (c) Conclusion ☐ (d) Hypothesis ☐

2. A testable explanation for an observation is called a:

   (a) Theory ☐ (b) Law ☐

   (c) Hypothesis ☐ (d) Fact ☐

Understanding

3. Which of the following is NOT a typical component of a scientific experiment?

   (a) Control group ☐ (b) Variable ☐

   (c) Personal opinion ☐ (d) Data collection ☐

Short Answer Question:

Applying

4. Show two main steps of the scientific method and give two reasons why experimentation is important.
5. Explain the role of a hypothesis in inquiry and state why it is important that a hypothesis is testable.

Long Answer Question:

Analyzing

6. Explain why the scientific method is considered the cornerstone of scientific research. Describe three different scenarios where the scientific method could be applied to solve a problem and discuss the importance of both observation and data analysis in reaching a valid conclusion.

SUMMARY

1. Introduction

- Humans are naturally curious, which drives exploration and learning, forming the basis of scientific inquiry.
- Science is about observing phenomena, asking questions, experimenting, and expanding knowledge.
- Curiosity fuels progress and innovation, encouraging us to question and understand the universe.

2. Science Universe

- Science explains the universe through observation and technology, such as telescopes that help us understand galaxies.
- Everyday phenomena, like plants growing toward light, are examples of scientific principles in action.

3. What is Science?

- Science is a systematic approach to understanding the world.
- Science surrounds us—from blooming flowers to shining stars—demonstrating its practical impact on daily life.

4. Exploring Our Home, Planet Earth

- Earth supports diverse life due to its unique resources like air, water, and sunlight.
- Examples include plant germination and animal metamorphosis, highlighting adaptation and survival.
- Ecosystems are interconnected webs of life that regulate processes like air and water purification.

5. Importance of Food and Water

- **Food:** Fuels growth and repair, providing essential nutrients. Cultural diversity in food reflects nature's richness.
- **Water:** Vital for hydration, agriculture, and ecosystems. Its properties, such as existing in three states, make it indispensable.

6. The Scientific Method

- A structured process for exploring problems and finding solutions.
- **Steps:**
  - **Observation:** Identify something intriguing.
  - **Question:** Frame specific inquiries.
  - **Hypothesis:** Form educated guesses.
  - **Experiment:** Test hypotheses systematically.
  - **Analysis:** Examine results to find patterns.
  - **Conclusion:** Validate or revise hypotheses

Example Based Questions

Multiple Choice Questions

1. What helps flowers bloom beautifully in a garden?

(a) Rain only

(b) Sunlight and temperature through photosynthesis

(c) Just soil nutrients

(d) Strong winds

Answer: (b) Sunlight and temperature through photosynthesis

Explanation: Flowers respond to sunlight and temperature. Through photosynthesis, plants use sunlight to make their own food, which helps them grow and bloom. Rain and soil are important, but without sunlight, plants cannot produce food. Strong winds don't help flowers bloom.

2. When ice melts in your juice, which change is happening?

(a) Liquid to gas (b) Gas to solid

(c) Solid to liquid (d) Liquid to solid

Answer: (c) Solid to liquid

Explanation: Melting is the process where a solid changes into a liquid because of heat. Ice (solid) takes in heat from the juice and turns into water (liquid). This is a change in the state of matter.

Short Answer Questions

5. Why do astronauts use the scientific method while growing food in space?

Answer: Astronauts use the scientific method because conditions in space are very different from Earth. In microgravity, plants may not grow in the same way. By using the scientific method—making observations, forming hypotheses, conducting experiments, and drawing conclusions—astronauts can test how light, water, soil, and air affect plants in space. This helps them discover the best way to grow food, which is important for long space journeys and future space missions.

6. Give one difference between an observation and a conclusion in the scientific method.

Answer: An observation is something that we notice directly using our senses or instruments. For example, "the plant grew 5 cm taller in a week". A conclusion is the explanation or decision we make after studying and analyzing those observations. For example, "plants grow faster in sunlight than in shade". Thus, observation is about what we see or measure, while conclusion is about the meaning we take from it.

7. Name two ways scientists study the universe.

Answer: Using telescopes: Scientists use optical telescopes and radio telescopes to observe stars, planets, galaxies, and other heavenly bodies. Telescopes help us see far-away objects and collect light or radio waves from space.

Sending satellites and space probes: Space agencies send satellites and spacecraft into space to study planets, moons, and even distant asteroids. For example, satellites give us images of Earth and Mars, while space probes like Voyager explore the outer solar system.

Long Answer Questions

8. Riya noticed that the Moon looks different on different nights. She wanted to study this scientifically. Write the steps of the scientific method she would follow.

Answer: Observation: Riya saw that the Moon looks different in the sky every night.

Question: She wondered, "Why does the Moon keep changing its shape?"

Hypothesis: She guessed that maybe clouds are covering the Moon and changing its shape.

Experiment/Investigation: Riya carefully observed the Moon for a full month and kept daily notes. She also compared her observations with information in science books.

Result: She found that the changes in the Moon are regular and follow a cycle, not because of clouds.

Conclusion: The different shapes are due to the revolution of the Moon around Earth. These are called phases of the Moon.

Gap Analyzer™
Complete Chapter Test

EXERCISE

A. Choose the correct answer.

1. What drives scientific inquiry?
   (a) Laziness ☐ (b) Curiosity
   (C) Habit ☐ (d) Guesswork
2. Which tool is commonly used to observe distant galaxies?
   (a) Microscope ☐ (b) Stethoscope ☐
   (c) Telescope ☐ (d) Thermometer ☐
3. Why are metals commonly used for making utensils?
   (a) Cooking food ☐ (b) Air purification ☐
   (c) Traveling ☐ (d) Painting ☐
4. Which property of water makes it indispensable for life?
   (a) It is colorful ☐ (b) It has three states ☐
   (c) It is heavy ☐ (d) It is sticky ☐
5. What is the first step in the scientific method?
   (a) Analysis ☐ (b) Hypothesis ☐
   (c) Observation ☐ (d) Experiment ☐

B. Fill in the blanks.

1. The systematic study of the world around us is called _____.
2. Telescopes help us understand _____ and other celestial bodies.
3. Food provides energy and helps in _____ and repair.
4. Materials like metal and plastic are chosen for their specific _____.
5. The steps of the scientific method include observation, hypothesis, and _____ testing.

C. Write True or False.

1. Science only involves observing nature without conducting experiments. _____
2. Recycling materials reduces waste and conserves resources. _____
3. Earth supports life due to its unique resources like water, air, and sunlight. _____
4. Food is not essential for growth and repair of the body. _____
5. Hypotheses in science are tested through experiments. _____

D. Define the following terms.

1. Science
2. Ecosystem
3. Hypothesis
4. Observation
5. Materials

E. Match the columns.

	Column A		Column B
1.	Telescope	(a)	Plastic and Paper
2.	Ecosystem	(b)	Observing galaxies
3.	Food	(c)	Growth and repair
4.	Scientific method	(d)	Interconnected life web
5.	Materials	(e)	Structured problem-solving

F. Assertion and Reason

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation1 of A.

(c) A is true but R is false.

(d) A is false but R is true.

(e) Both A and R are false.

1. **Assertion (A):** Science helps us understand how a rainbow forms.

   Reason (R): Science is a systematic way of gaining knowledge about the natural world through observation and experimentation.

2. **Assertion (A):** A hypothesis is always proven correct at the end of an experiment.

   Reason (R): A hypothesis is an educated guess that needs to be tested and can be either supported or refuted by evidence.

3. **Assertion (A):** The Universe only includes Earth and the Moon.

   Reason (R): The Universe encompasses all of space and time and their contents.

G. Give reasons for the following statements.

1. Curiosity is essential for scientific progress.
2. Conservation of food and water is important for sustainability.
3. Recycling helps reduce environmental waste.
4. Understanding ecosystems ensures balanced resource usage.
5. The scientific method is vital for solving problems systematically.

H. Answer in brief.

1. Why is curiosity considered the driving force behind science?
2. How does understanding materials contribute to conservation?
3. What role do ecosystems play in maintaining life on Earth?
4. Describe the practical importance of water for humans and ecosystems.
5. How does observation help in the scientific method?

I. Answer in detail.

1. Explain the importance of science in understanding the world around us.
2. Describe the steps of the scientific method with examples.
3. How do ecosystems support and regulate life processes on Earth?
4. Discuss the significance of conserving food and water for future generations.
5. How does science improve daily life through technology and innovation?

SKILL-BASED PRACTICE

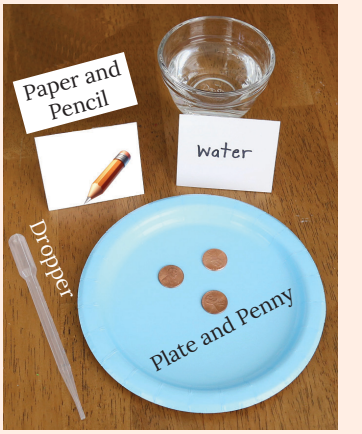
Activity Time

STEM

The "Penny Drop" Experiment

Materials Needed:

- A penny
- A small eyedropper or straw
- A cup of water
- A clean, dry surface
- Paper and pencil for recording



Materials Required

Activity Steps:

1. **Ask a Question:** How many drops of water can a penny hold before the water spills over?
2. **Form a Hypothesis:** Make an educated guess. (e.g., "I think a penny can hold 15 drops of water.")
3. **Experiment:**
    - Place the penny flat on a dry surface.
    - Use the eyedropper to carefully add drops of water to the penny, one at a time.
    - Count each drop until the water spills over.
    - Record the number of drops.
    - Repeat the experiment at least three more times to get reliable data.
4. **Analyze Data:** Calculate the average number of drops the penny held. Look for consistency or variation in your results.
5. **Draw a Conclusion:** Compare your average result to your initial hypothesis. Was your hypothesis supported or refuted?

Questions to Answer:

- What was your hypothesis for this experiment?
- What was the average number of drops your penny held?
- Was your hypothesis supported by your results? Explain why or why not.
- How does repeating the experiment help you draw a more reliable conclusion?

Skills Covered: Following Scientific Method, Observation, Data Collection & Recording, Simple Experimentation, Drawing Conclusions

Creativity

Art

"My Science Universe" Collage

Task: Create a collage that visually represents your understanding of the "Science Universe." Include images or drawings that symbolize different branches of science (e.g., astronomy, biology, chemistry, physics, geology) and objects within the Universe (e.g., planets, stars, cells, atoms, elements, landscapes).

Materials to Use:

- Large sheet of paper or cardboard
- Old magazines, newspapers, printed images from the internet
- Scissors
- Glue
- Markers, colored pencils (for drawings or labels)

Materials Required

Questions to Answer:

- What different branches of science did you include in your collage, and what images represent them?
- How did you convey the vastness and diversity of the "Science Universe" in your artwork?
- What is one new scientific concept or object you learned about while creating this collage?
- How does art help you express your understanding of scientific ideas?

Skills Covered: Creativity, Data Visualization, Understanding Disciplines, Artistic Representation

Scientific Method Storytelling

Group Activity

The Mystery of the Missing Plant

Activity Instructions: Work in a group of 3-4 students.

1. **Scenario:** You have a potted plant that was thriving, but now it's wilting and losing leaves. You need to figure out why using the Scientific Method.
2. **Step 1: Observation & Question:** As a group, make initial observations about the plant (e.g., soil dry, leaves yellow).7 Formulate a specific question about why the plant is wilting.
3. **Step 2: Hypothesis:** Brainstorm several possible reasons (hypotheses) for the wilting plant. Choose one testable hypothesis.
4. **Step 3: Design Experiment:** Outline a simple experiment to test your chosen hypothesis. What materials would you need? What would be your control group? What would be your variable?
5. **Step 4 & 5: Prediction & Conclusion:** Describe what data you would collect and what kind of conclusion you would expect to draw if your hypothesis were correct (or incorrect).

Questions to Answer:

- What specific question did your group ask about the wilting plant?
- What was your chosen hypothesis?
- Describe the experimental setup your group designed, including your control and variable.
- What data would you collect, and how would you use it to draw a conclusion?

Skills Covered: Problem-Solving, Applying Scientific Method, Critical Thinking, Collaborative Inquiry

The Mystery of the Green Puddle

Case Study

One morning, a child notices a strange green puddle on the playground that wasn't there yesterday. The child is curious about why it's green.

Guiding Questions:

1. What is the child's initial observation?
2. What question might the child ask about the green puddle?
3. Formulate a hypothesis about why the puddle is green (e.g., "The puddle is green because algae are growing in it.").
4. What simple experiment or observation could the child do to test their hypothesis (e.g., collect a sample, look under a magnifying glass, wait a few days)?
5. If the puddle turned brown after a few days, what conclusion might the child draw?

Growing Lettuce on the ISS (2015)

Source Based Question

In 2015, astronauts on the International Space Station (ISS) grew lettuce for the first time. They noticed that plants grow differently in space because there is very little gravity. The astronauts wanted to find out which kind of light (red, blue, or white) would help lettuce grow best.

Questions (with Scientific Method)

- What special thing did astronauts do on the ISS in 2015?
- Why does plant growth in space differ from growth on Earth?
- What question were the astronauts trying to answer about lettuce?
- In their experiment, what would they change (type of light)?
- What would they measure to know which lettuce grew better?
- If lettuce grew best under red light, what conclusion could they make?

Image Credit: NASA/ISS

Skills Covered: Observation, Questioning, Experimenting, Creating, Evaluating